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(54) Curved disc reflector

(57) An efficient lamp (10) includes a reflector (40), a filament (60), a reflective disc (20) and a lens (70). The filament (60) emits light that is reflected out the lens (70) by the reflector (40) and the reflective disc (20). The reflective disc (20) increases the efficiency of the lamp by reducing the amount of light that is absorbed by the reflector.

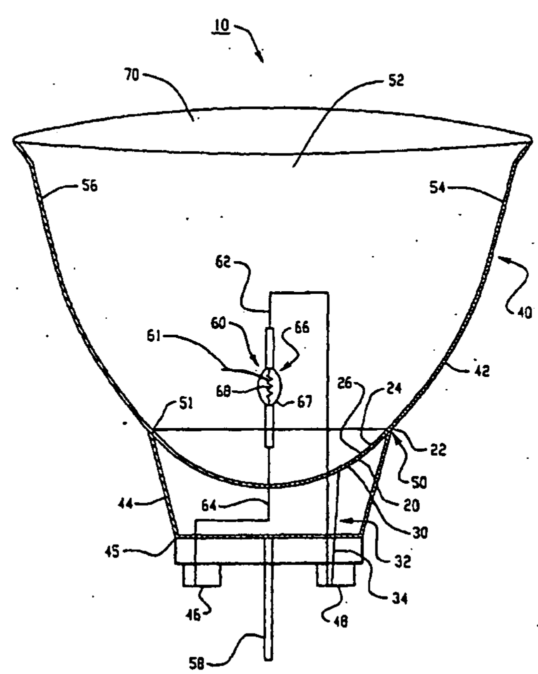

Fig. 3

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Description

[0001] The present invention relates to a reflector lamp. More particularly, the present invention relates to a reflector lamp that includes a curved reflective disc that prevents light from entering a bowl portion of the reflector, thereby reducing the amount of light lost due to multiple reflections.

[0002] Parabolic aluminized reflector (PAR) lamps include a reflector that has a reflective aluminum coating on its internal surface. In the early stages of development, aluminum was the only reflective coating used on the internal surface of the reflector. Now many different types of coatings are used to coat the interior surface of the reflector. The coating on the internal surface of the lamp reflects light out of the lamp. Most PAR reflectors include a first reflecting portion that transitions down to a bowl portion. The reflector absorbs some of the light and reflects the remainder of the light. More of the light that enters the bowl portion of the reflector is lost, because light that enters the bowl portion of the reflector is reflected more than once before leaving the lamp. Light lost as a result of multiple reflections is a significant source of inefficiency in PAR lamps.

[0003] Prior art lamps have attempted to minimize the size of the bowl portion of the reflector to reduce the amount of light that enters the bowl portion. The size of the bowl portion can only be reduced to a certain extent, as the bowl portion must be large enough to accommodate a filament and electrical contacts. A significant amount of light still enters the bowl portion of PAR lamps even with reduced bowl portions.

[0004] In PAR lamps, it is desirable to remove the air from a volume defined by the reflector and a lens overlying an end of the reflector and replace the air with an inert gas. Replacing the air in the lamp with an inert gas increases the life of the lamp. The lens of a PAR lamp is fused to the reflector so that the inert gas cannot leak out of the lamp. Fusing the glass of the lens and the reflector with a methane and oxygen flame is known as a hermetic seal. Lamps that utilize a hermetic seal have a hole or tube in the bowl portion of the reflector to remove air and add an inert gas to the lamp. The bowl portion of the reflector cannot be reduced in size to as great a degree, because the bowl portion must accommodate a tube or hole, as well as a filament and contacts. An undesirably large portion of light enters the bowl portion of PAR lamps that are filled with an inert gas.

[0005] Accordingly, there is a need for a more efficient PAR lamp that minimizes the amount of light that lost as a result of multiple reflections.

[0006] The present invention is directed to a lamp. The lamp includes a reflector, a filament, a reflecting disc and a lens. The reflector has a large first portion that transitions into a reduced diameter bowl portion. First and second contacts extend from the bowl portion of the reflector. The filament has first and second leads that are connected to the first and second contacts. The filament has a light emitting portion that is located in the first portion of the reflector. The reflecting disc is located in the reflector near a transition from the first reflecting portion to the bowl portion. The reflecting disc's outer periphery is adapted to fit in the reflector near the transition. The reflecting disc has a concave surface that extends radially inward from the outer periphery. The concave surface is adapted to reflect light. The reflective disc has an opening in it for the filament to pass through. The lens is connected to an end of the reflector to close the lamp.

[0007] Additional features of the invention will become apparent and a fuller understanding obtained by reading the following detailed description made in connection with the accompanying drawings, in which

Figure 1 is a one-half sectional view of a reflector and a light source;
Figure 2 is a one half sectional view of a reflector, a reflective disc and a light source;
Figure 3 is sectional view of a lamp with a reflective disc;
Figure 4 is a top plan view of a reflective disc; and
Figure 5 is a front elevational view of the reflective disc.

[0008] The present invention is directed to a lamp 10 with a reflecting disc 20 that reflects light out of the lamp, as can best be seen in Figure 3. The lamp 10 has a reflector 40 with a first reflecting portion 42 that transitions into a reduced diameter bowl portion 44. First and second lamp contacts 46, 48 extend from the reduced diameter bowl portion 44. First and second leads 62, 64 of a filament 60 are connected to the first and second contacts 46, 48. The filament 60 has a light emitting portion 66 that is located in the first portion 42 of the reflector.

[0009] A reflecting disc 20 of the present invention is positioned in the reflector 40, near an area of transition 50 where the reflector 40 transitions from the first reflecting portion 42 to the reduced diameter bowl portion 44. The reflecting disc 20 includes an outer periphery 22 adapted to fit within the reflector 40 near the transition 50 from the first reflecting portion to the reduced diameter bowl portion. An upper one of the surfaces 24 of the disc 20 facing the filament is a concave surface 24, which extends radially inward from the outer periphery 22. The concave surface 24 of the reflecting disc 20 is adapted to reflect light out of the reflector 40. The reflective disc 20 has an opening 26 in it for the filament 60 to pass through. A lens 70 that is hermetically sealed to an open end 52 of the reflector closes the lamp.

[0010] In one embodiment, the lamp 10 is a PAR lamp. PAR is an acronym for parabolic aluminized reflector. A PAR lamp includes a glass reflector 40 with a light source 60, such as a double-ended quartz filament. Light that is emitted by the PAR lamp is emitted through the lens 70, because the inner surface 54 of the reflector 40 is coated with an opaque film 56 of aluminum. The inner surface 54 of the reflector can also be coated with any other opaque reflective material. The light emitted through the lens 70 of a PAR lamp is called face lumen.

[0011] Although a PAR lamp 10 emits light only through the area of the lens, the filament 60 emits light in all directions. The light that is emitted by the filament 60 in a direction other than toward the lens is reflected out the lens 70 by the reflector 40. The total lumen produced by the light source 60 is called the spherical lumen. The spherical lumen produced by the filament is always greater than the face lumen of the lamp, because the aluminum film 56 absorbs some of the light before directing the light out the lens 70. For example, aluminum film that is 84% reflective reflects 84% of the incident light and absorbs 16% of the incident light. The lumen efficiency of a PAR lamp 10 is defined by the ratio of the PAR face lumen to the spherical lumen produced by the light source or filament 60. The lumen efficiency is always less than 100%, because the coating 56 on the internal surface of the reflector absorbs some of the light.

[0012] For a selected light source or filament 60, the reflector 40 and the position of the light source 60 in the reflector determine the PAR lumen efficiency. In one embodiment of the lamp 10, a K type PAR 38 reflector 40 is used. The PAR reflector is made up of a large primary parabola 42 that transitions into a secondary parabola 43 and a base 45. In a K type PAR reflector 40 the equation that defines the primary parabola 42 is $y=kx^2$ where k is any constant. It should be understood that this invention relates to all reflectors, including reflectors that do not have a parabolic portion. The first portion 42 is not necessarily defined by a parabola. The first reflecting portion may be parabolic, elliptical or any other shape. In one embodiment, the reflector is a GE PAR 38 K type reflector. A one half section of the GE PAR 38 K type reflector 40 is best seen in Figure 1 and is sold by General Electric Corporation, Nela Lamp Division as part of several lamps including 60 PAR/H/SP10, 90 PAR/H/SP10 and 100 PAR/HIR/SP10. The outer diameter of a GE PAR 38 K type reflector 40 is 38 x 1/8 inch or 4-3/4 inches.

[0013] The secondary parabola 43 and the base 45 form a bowl portion 44. The bowl portion 44 accommodates a filament 60, such as a double-ended quartz filament tube. The bowl portion 44 of a PAR reflector 40 also has enough room to make the electrical connections of the filament leads 62, 64 to the contacts 46, 48 and to accommodate an exhaust tube 58 for removing gas from the lamp 10.

[0014] When the reflective disc 20 of the present invention is not used, approximately 45% of the light emitted by the filament 60 enters the bowl portion 44 of the reflector. The reflector 40 reflects the light that enters the bowl portion 44 at least twice before the light exits the lamp through the lens 70. Reflecting the light emitted by the filament 60 two times before the light exits the lamp is referred to as double bounce. Some of the light is lost each time the light is reflected. In one embodiment, the inner surface 54 of the reflector 40 is coated with aluminum. The average luminous reflectivity of the aluminum used to coat the reflector is between 80% and 90%. 10% to 20% of the light is absorbed by the reflector for each reflection. In another embodiment, the inner surface of the reflector is coated with silver. The average luminous reflectivity of the silver is between 90% and 98%. The amount of light that is absorbed by the reflector 40 can be minimized by minimizing the amount of light that is reflected off the reflector more than once. This is accomplished by minimizing the amount of light that enters the bowl portion 44.

[0015] Fig. 1 shows a one half-section view of a PAR lamp reflector 40 and a light source 60. The center 61 of the light source is located at the focal point 47 of the first reflecting portion of the reflector. The light source is not a point light source. The light source is depicted as a point light source at the focus point 47 to explain how some of the light emitted by the light source 60 is lost. Fig.1 shows four lines extending from the center 61 of the light source 60 that define five angles, A, B, C, D and E. The lines divide the section of the PAR reflector 40 into five corresponding regions. For a GE-PAR38 K type reflector, angles A, B, C, D and E are 53, 42, 43, 11, 31 degrees, respectively.

[0016] Light emitted from the center of the light source into region A will travel toward the lens 70. The light does not reflect off the reflector 40 before exiting the lamp 10 and therefore no light emitted into this region is lost due to absorption.

[0017] The light emitted from the center 61 of the light source 60 into region B will hit the first reflecting portion 42 of the reflector 40. The light emitted into region B will be reflected by the coating 56 on the first reflecting portion only once before passing through the cover lens 70. This is referred to as a single bounce. The light emitted from the focal point 47 of the parabola or center 61 of the light source is reflected by the first reflecting portion 42 and exits the lamp 10 parallel to the y-axis, because light is emitted from the focal point of the parabola. For a GE PAR 38 reflector that has a luminous reflectivity of 84%, 16% of the light emitted into region B will be lost.

[0018] Light emitted into region C will reflect off the secondary parabolic portion 43 of the reduced diameter bowl portion 44. The aluminum film 56 will reflect light that is emitted from the center 61 of the light source 60 into region C twice before the light leaves the lamp 10. If the reflectance is 84%, only 71% of the light, which enters region C is emitted through the lens 70 of the lamp, because 16% of the light is absorbed upon the first reflection and 16% of the remaining light is absorbed upon the second reflection. (84% x 84% = 71%). This situation is called the double bounce.

[0019] Light emitted into regions D and E reflects off the sides and bottom or base 45 of the bowl portion 44 of the

reflector. Light emitted from the center 61 of the light source 60 that enters regions D and E will reflect off the reflector 40 two or more times before exiting the lamp 10. This region of the reflector is most inefficient, because much of the light is reflected more than two times, before it exits the lamp 10.

[0020] In one embodiment, the reflector 40 is a GE PAR 38 K type reflector. The GE PAR 38 K type reflector 40 has a large bowl portion 44 that accommodates part of the light source 60 and the leads 62, 64 and allows the air in the lamp 10 to be evacuated and replaced with an inert gas. The bowl portion 44 of the reflector includes an opening 58 for removing gas from the lamp 10 after the lens 70 and the reflector 40 are sealed together. The opening 58 in the reflector may be a hole in the bowl portion or a tube that extends into the bowl portion 44. The bowl portion of the GE PAR 38 K reflector 40 is large enough to accommodate the contacts 46, 48 and the opening 58 for the replacement of air in the lamp with an inert gas after the lamp 10 is sealed. Lamps that are filled with an inert gas have a longer life than lamps that contain air, because the inert gas protects the welded joints from oxidation at the high lamp operating temperature.

[0021] A relatively large percentage of the light emitted by the filament 60 enters the bowl portion 44 of a PAR lamp, because the bowl portion is sized to accommodate two contacts 46, 48 and an exhaust tube 58. For a lamp with a General Electric PAR 38 reflector 40, about 45% of the light emitted by the double-ended quartz filament 60 will enter the bowl portion 44. Approximately 40% of the light that enters the bowl portion 44 is absorbed by the reflector before it passes through the lens 70 of the lamp. For a GE PAR 38 lamp without a reflective disc 20, about 20% of the light emitted by the filament 60 is lost by entering the bowl portion and being reflected numerous times. The inefficiency of the bowl portion 44 of the reflector causes a standard GE PAR38 lamp without a reflective disc to have a 70% to 75% PAR lumen efficiency.

[0022] The two leads 62, 64 of the light-producing filament 60 are electrically connected to the two contacts 46, 48 that extend from the bowl portion 44 of the reflector. In one embodiment, the filament 60 is a double-ended quartz filament tube 60. A double ended quartz filament tube 60 is a standard light source in PAR lamps. A double-ended quartz filament with its center at the focal point of the parabolic surfaces of the reflector and the reflective disc is shown in Fig. 3. The double ended quartz filament tube 60, shown in Fig. 3, has an elliptical bulb 67, a tungsten coil 68 and two leads 62, 64 that are welded to the filament 60. The two leads 62, 64 of the double-ended quartz filament 60 are inserted into two contact ferrule holes for brazing.

[0023] The lens 70 closes the filament 60 in the lamp 10. In the exemplary embodiment, the lens 70 is connected to the reflector 40 by a hermetic seal. A hermetic seal is accomplished by fusing of the glass of the lens 70 to the glass of the reflector 40 by heating the areas to be joined with a methane and oxygen flame. The hermetic seal prevents the inert gas from leaking out of the lamp 10. After the lens 70 is sealed to the reflector 40, any air in the lamp 10 is replaced with an inert gas. In another embodiment of the invention, the lens is sealed to the reflector with epoxy. When the lens is sealed to the reflector with epoxy, the air is not evacuated from the lamp.

[0024] Introducing a reflective disc 20 into the reflector 40 to prevent light from entering the bowl portion 44 increases the lumen efficiency of a PAR lamp 10. The disc 20 may be formed to include a surface with any appropriate reflective curvature. For example, the disc 20 may have a reflective surface 24 that is parabolic, spherical, elliptical or hand sketched. The concave surface 24 may or may not be defined by a mathematic equation. The reflective disc 20 reflects light emitted by the light source 60 out the lens of the lamp, before the light reaches the bowl portion 44, where it would be reflected more than once before becoming useful face lumen output. Light that is incident on the reflective disc 20 is reflected once before passing through the lamp lens 70. The reflective disc 20 increases the efficiency of PAR lamps, because the reflective disc minimizes the light that enters the bowl portion 44. The insertion of the reflective disc 20 greatly increases the amount of light that is reflected once before exiting the lamp 10. By inserting a reflective disc 20 into the PAR lamp 10, higher face lumen output is achieved using the same reflector and double-ended quartz filament.

[0025] Fig. 2 shows a half-sectional view of a reflective disc 20 ir, a PAR reflector 40. The reflective disc 20 begins at the bottom edge 51 of the first reflecting portion, where the first reflecting portion 42 transitions to the bowl portion 44. In the exemplary embodiment, the concave surface 24 of the disc continues the parabolic curvature of the first reflector portion 42. In this embodiment, the curvature of the reflector's first reflecting portion 42 and the reflective disc's concave surface 24 are defined by the same equation. In the case of the GE PAR 38 reflector 40, the curvature of the reflector 40 and the reflective disc 20 is defined by the equation: $y=0.48x^2$, where x is the horizontal distance from the origin of the first reflecting portion 42 and y is the vertical distance, defining the reflector shape.

[0026] Fig. 3 shows a full section view of a PAR reflector 40 with a reflective disc 20 mounted in it. Inserting the reflective disc 20 into the reflector does not change the focused position of the light source 60. The reflective disc 20 is sized so that the dimensions of the PAR reflector 40 do not have to be changed. When looking into the reflector 40 that has a reflective disc 20 in it, the internal surface 54 of the reflector appears to be defined by a single parabola and does not appear to have a bowl portion 44. The curved disc fits not only in aluminized parabolic PAR lamps, but also other PAR lamps with non-parabolic reflectors having any kind of coating, silver or some reflective material. Advantageously, no multiple reflections occur when the reflective disc 20 is used in the PAR lamp 10.

[0027] The reflective disc 20 prevents most light emitted by the filament 60 from entering the bowl portion 44 of the

reflector. A small amount of light is lost that passes through the opening 26 in the disc for the light source 60. The opening 26 in the disc is defined by the size and shape of the light source 60. For a double ended quartz filament, the opening 26 in the disc is a slot with a larger circular opening in the middle. The losses, due to light that passes through the opening 26 for the light source, are considerably less than the losses due to multiple bounces caused by the bowl portion 44, when a reflective disc is not used. As a result, the lumen efficiency of the PAR lamp 10 is significantly increased.

[0028] Table 1 below shows how introducing a reflective disc 20 into a GE PAR 38 lamp enhances its performance. Table 1 also shows how lumen efficiency, lumen per Watt, center beam candle power, beam angle, beam lumen and field angle are effected by adding reflective discs 20 with different reflective coatings 28 into reflectors with different reflective coatings 56. As noted above, the lumen efficiency is the ratio of the lumen emitted through the lens 70 to the lumen emitted by the filament 60. Lumen per Watt is the number of lumen emitted through the lens of the lamp divided by the power (W) drawn by the lamp. Center beam candlepower (CBCP) is the value of the light flux intensity, measured on the beam axis. CBCP is measured in candelas. Beam angle is the angle, measured on both sides of a central plane, which includes 50% of the CBCP at a distance of 10 feet. Beam angle is measured in degrees. Beam lumen is the total lumen output within the corresponding beam angle. Field angle is the angle, measured on both sides of a central plane, which includes all but 10% of the CBCP at a distance of 10 feet. Field angle is measured in degrees. The first column of Table 1 shows that the PAR efficiency for PAR 38 lamps without the reflective discs 20 is 74.8%. The use of a reflective disc 20 increases the PAR lumen efficiency significantly. The second through fourth columns of Table 1 show that the lumen efficiency with a reflective disc ranges from 79.2% when a protected silver coated disc is used with an aluminum reflector to 91% when a silver coated reflective disc is used with a silver lined reflector. The lumen per watt also increased accordingly as shown in Table 1 below.

Table 1

	PAR 38 Lamps Without Reflective Discs	Al PAR38 Lamps With Ag Reflective Discs	Ag PAR38 Lamps With Ag Reflective Discs	Al PAR38 Lamps With Protected Ag Reflective Discs	Al PAR38 Lamps With Al Reflective Discs
Lumen Efficiency	74.8%	85.1%	91.0%	79.2%	80.5%
Lumen Per Watt	17.6	20.3	21.6	18.5	18.7
Center Beam Candle Power	21448	19854	21252	17669	18554
Beam Angel 50%	8.38	9.00	9.28	9.00	8.76
Beam Lumen	479.4	495.4	568.2	448.6	449.0
Field Angle 10%	19.0	22.0	22.4	22.6	21.8
Field Lumen	1109.0	1298.6	1405.4	1169.6	1184.4

[0029] Fig. 4 shows a top plan view of the reflective disc 20 and Fig. 5 shows a front elevational view of the reflective disc. In one embodiment, the disc 20 is made of stainless steel. However, other kind of materials such as glass may also be used. In the exemplary embodiment, the reflective disc 20 is made of stainless steel and is approximately 0.7 millimeters thick.

[0030] In the preferred embodiment, the first concave surface 24 is coated with a reflective material. The reflective coating 28 that is on the concave surface 24 and may be aluminum, silver or any other reflective material. The disc 20 may be coated with silver or aluminum. The disc 20 can be coated with any reflective material by any coating technology. For example, the disc may be coated using vacuum deposition technology, a chemical reaction or electroplating. It is also appropriate to coat the entire reflective disc, or any portion of the disc, rather than only coating the concave surface 24. Coating the entire disc may be accomplished by plating the disc by dipping it in a plating bath. If the material the disc 20 is made from is highly reflective no coating is required. For example, a disc made from a shiny aluminum or aluminum alloy sheet does not require a coating. A disc that is made from a highly polished steel sheet also does not require a reflective coating. An advantage of using steel rather than aluminum to make the disc is that the wire 34 can easily be welded to a disc 20 made of steel.

[0031] The reflecting disc 20 may be attached to the lamp 10 by any means. In the preferred embodiment, the disc

20 includes a second surface 30 that extends radially inward from the outer periphery 22. Attachment structure 32 is attached to the second surface 30 for holding the disc 20 in place with respect to the reflector 40. In the exemplary embodiment, a wire 34 is welded to the second surface 30 of the disc 20 and to one of the contacts 46, 48 for holding the reflector and disc in place with respect to one another. The reflective disc mounting wire 34 is brazed with one of the filament leads 62, 64 in one of the contact ferrule holes to hold the disc in position. The wire 34 is simultaneously welded with one lead of the filament 60, when the two leads of the filament are brazed to the two contacts 46, 48. One of the contacts 46, 48 of the lamp may be a ground contact. Preferably, the wire 34, supporting the reflective disc 20 is attached to the ground contact. In one embodiment, the wire 34 is an iron chromium alloy wire that is 0.5 mm thick and 25 mm long. The wire 34 is welded on the backside of the disc near the opening 26.

[0032] The PAR lumen efficiency is increased significantly by introducing the reflective disc 20 into the reflector. The disc is compatible with the current sealing and exhausting processes of current GE PAR lamps. The more efficient PAR lamp with reflective disc maintains beam quality and retains the benefits of a hermetic seal.

[0033] Many modifications and variations of the invention will be apparent to those skilled in the art from the foregoing detailed description. GE PAR 38 lamps have been used by way of example to demonstrate the current invention, which may be applied to other reflector lamps.

[0034] For completeness, various aspects of the invention are set out in the following numbered clauses:

1. A disc 20 for reflecting light out of a lamp 10, the lamp including a reflector 40 having a large first reflecting portion 42 transitioning into a reduced diameter bowl portion 44, first and second contacts 46,48 extending from the bowl portion, a filament 60 having first and second leads 62, 64 connected to the first and second contacts, the filament having a light emitting portion 66 located in the large first reflecting portion and a lens 70 connected to an end of the large first reflecting portion 42 of the reflector 40 to close the lamp 10, said disc 20 comprising:

   an outer periphery 22 adapted to fit within the reflector 40 near a transition 50 from said first reflecting portion 42 to a reduced diameter bowl portion 44;
   a first concave surface 24 extending radially inward from said outer periphery 22 adapted to reflect light; and
   an opening 26 in said disc for said filament 60 to pass through said disc 20.

2. The disc 20 of clause 1 wherein said first concave surface 24 of the disc is coated with a reflective material.

3. The disc 20 of clause 1 wherein said first concave surface 24 is defined by a parabola.

4. The disc 20 of clause 1 wherein said first concave surface 24 is spherical.

5. The disc 20 of clause 1 wherein said first concave surface 24 is elliptical.

6. The disc 20 of clause 1 wherein said first concave surface 24 continues the curvature of the large first reflecting portion 42 of the reflector 40.

7. The disc 20 of clause 1 further comprising:

   a second surface 30 extending radially inward from said outer periphery 22; and
   an attachment structure 32 attached to said second surface 30 for holding said disc in place with respect to said reflector 40.

8. The disc 20 of clause 1 wherein said first reflective concave surface 24 is coated with aluminum.

9. The disc 20 of clause 1 wherein said first reflective concave surface 24 is coated with silver.

10. A lamp comprising:

   a reflector 40 having a large first reflecting portion 42 transitioning into a reduced diameter bowl portion 44;
   first and second contacts 46, 48 extending from said bowl portion 44;
   a filament 60 having first and second leads 62, 64 connected to said first and second contacts, said filament having a light emitting portion 66 located in said large first reflecting portion 42;
   a reflecting disc 20 located in said reflector near a transition 50 from said large first reflecting portion to the reduced diameter bowl portion, said reflecting disc includes an outer periphery 22 adapted to fit in said reflector near said transition, a first concave surface 24 extending radially inward from said outer periphery adapted to

reflect light and an opening 26 to through said disc for said filament to pass through said disc; and
a lens 70 connected to an end 52 of said reflector to close the lamp.

11. The lamp 10 of clause 10 wherein said first concave surface 24 of the disc 20 is coated with a reflective material.

12. The lamp 10 of clause 10 wherein said first concave surface 24 of the disc 20 is defined by a parabola.

13. The lamp 10 of clause 10 wherein said first concave surface 24 of the disc 20 is spherical.

14. The lamp 10 of clause 10 wherein said first concave surface 24 of the disc 20 is eliptical.

15. The lamp 10 of clause 10 wherein said first concave surface 24 of the disc continues the curvature of said large first reflecting portion 42.

16. The lamp of clause 10 further comprising:

a second surface 30 extending radially inward from said outer periphery 22; and
an attachment structure 32 attached to said second surface of the disc 20 for holding said disc in place with respect to said reflector 40.

17. The lamp 10 of clause 10 wherein said first reflective concave surface 24 is coated with aluminum.

18. The lamp 10 of clause 10 wherein said large first reflective concave surface 24 is coated with silver.

19. The lamp 10 of clause 10 wherein the connection of said lens 70 to said reflector 40 is a hermetic seal.

20. The lamp 10 of clause 10 further comprising an opening 26 in said bowl portion 44 for removing gas from said lamp.

21. The lamp 10 of clause 10 further comprising:

a second surface 30 extending radially inward from said outer periphery 22; and
a wire 34 attached to said second surface of the disc 20 and one of said contacts for holding paid disc 20 in place with respect to said reflector.

22. The lamp 10 of clause 21 wherein the wire 34 is attached to a ground contact of the one of said contacts.

Claims

1. A disc 20 for reflecting light out of a lamp 10, the lamp including a reflector 40 having a large first reflecting portion 42 transitioning into a reduced diameter bowl portion 44, first and second contacts 46,48 extending from the bowl portion, a filament 60 having first and second leads 62, 64 connected to the first and second contacts, the filament having a light emitting portion 66 located in the large first reflecting portion and a lens 70 connected to an end of the large first reflecting portion 42 of the reflector 40 to close the lamp 10, said disc 20 comprising:

   an outer periphery 22 adapted to fit within the reflector 40 near a transition 50 from said first reflecting portion 42 to a reduced diameter bowl portion 44;
   a first concave surface 24 extending radially inward from said outer periphery 22 adapted to reflect light; and
   an opening 26 in said disc for said filament 60 to pass through said disc 20.

2. The disc 20 of claim 1 wherein said first concave surface 24 of the disc is coated with a reflective material.

3. The disc 20 of claim 1 wherein said first concave surface 24 continues the curvature of the large first reflecting portion 42 of the reflector 40.

4. The disc 20 of claim 1 further comprising:

a second surface 30 extending radially inward from said outer periphery 22; and
an attachment structure 32 attached to said second surface 30 for holding said disc in place with respect to said reflector 40.

5. A lamp comprising:

a reflector 40 having a large first reflecting portion 42 transitioning into a reduced diameter bowl portion 44;
first and second contacts 46, 48 extending from said bowl portion 44;
a filament 60 having first and second leads 62, 64 connected to said first and second contacts, said filament having a light emitting portion 66 located in said large first reflecting portion 42;
a reflecting disc 20 located in said reflector near a transition 50 from said large first reflecting portion to the reduced diameter bowl portion, said reflecting disc includes an outer periphery 22 adapted to fit in said reflector near said transition, a first concave surface 24 extending radially inward from said outer periphery adapted to reflect light and an opening 26 to through said disc for said filament to pass through said disc; and
a lens 70 connected to an end 52 of said reflector to close the lamp.

6. The lamp 10 of claim 5 wherein said first concave surface 24 of the disc 20 is coated with a reflective material.

7. The lamp 10 of claim 5 wherein said first concave surface 24 of the disc continues the curvature of said large first reflecting portion 42.

8. The lamp of claim 5 further comprising:

a second surface 30 extending radially inward from said outer periphery 22; and
an attachment structure 32 attached to said second surface of the disc 20 for holding said disc in place with respect to said reflector 40.

9. The lamp 10 of claim 5 wherein the connection of said lens 70 to said reflector 40 is a hermetic seal.

10. The lamp 10 of claim 5 further comprising:

a second surface 30 extending radially inward from said outer periphery 22; and
a wire 34 attached to said second surface of the disc 20 and one of said contacts for holding paid disc 20 in place with respect to said reflector.

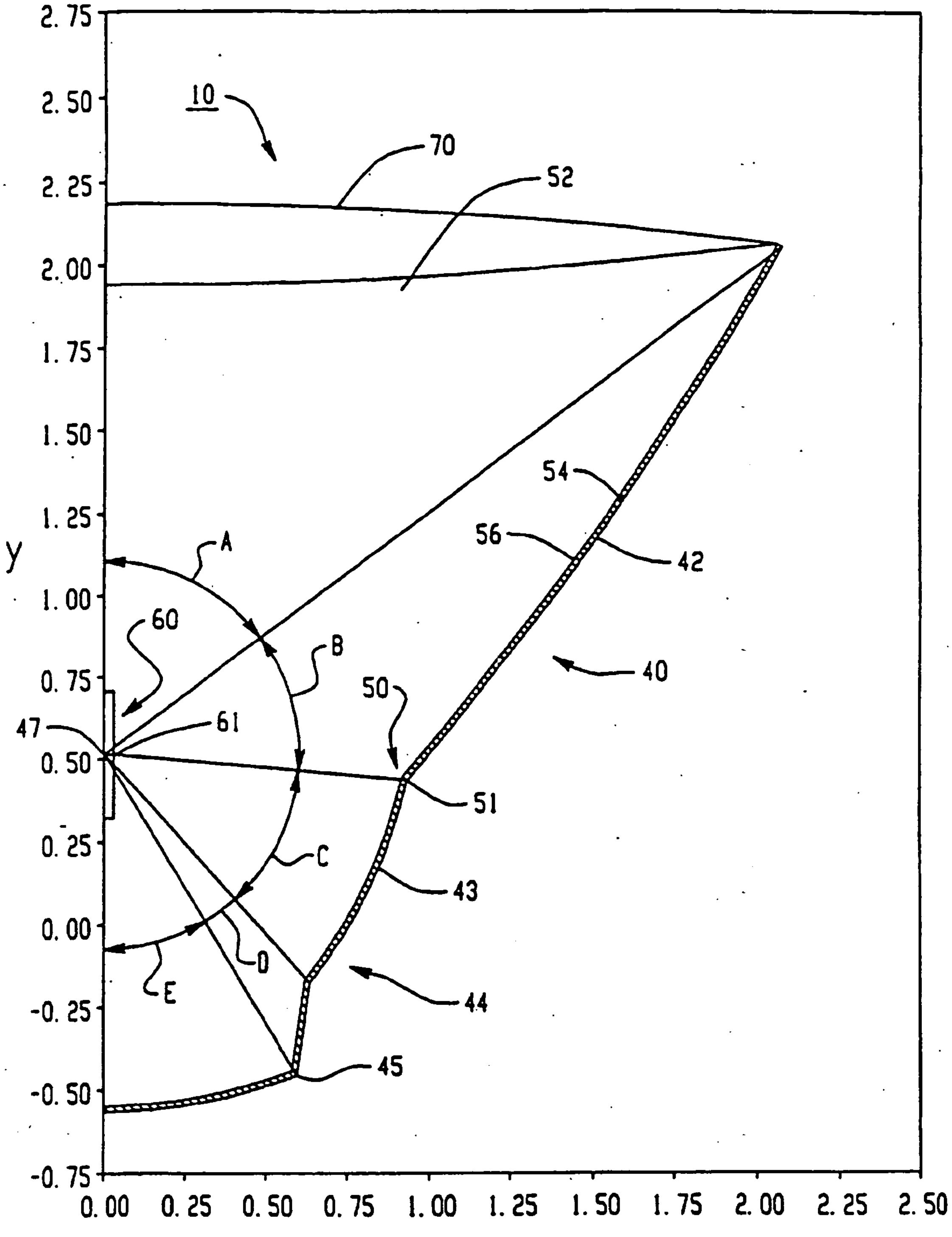

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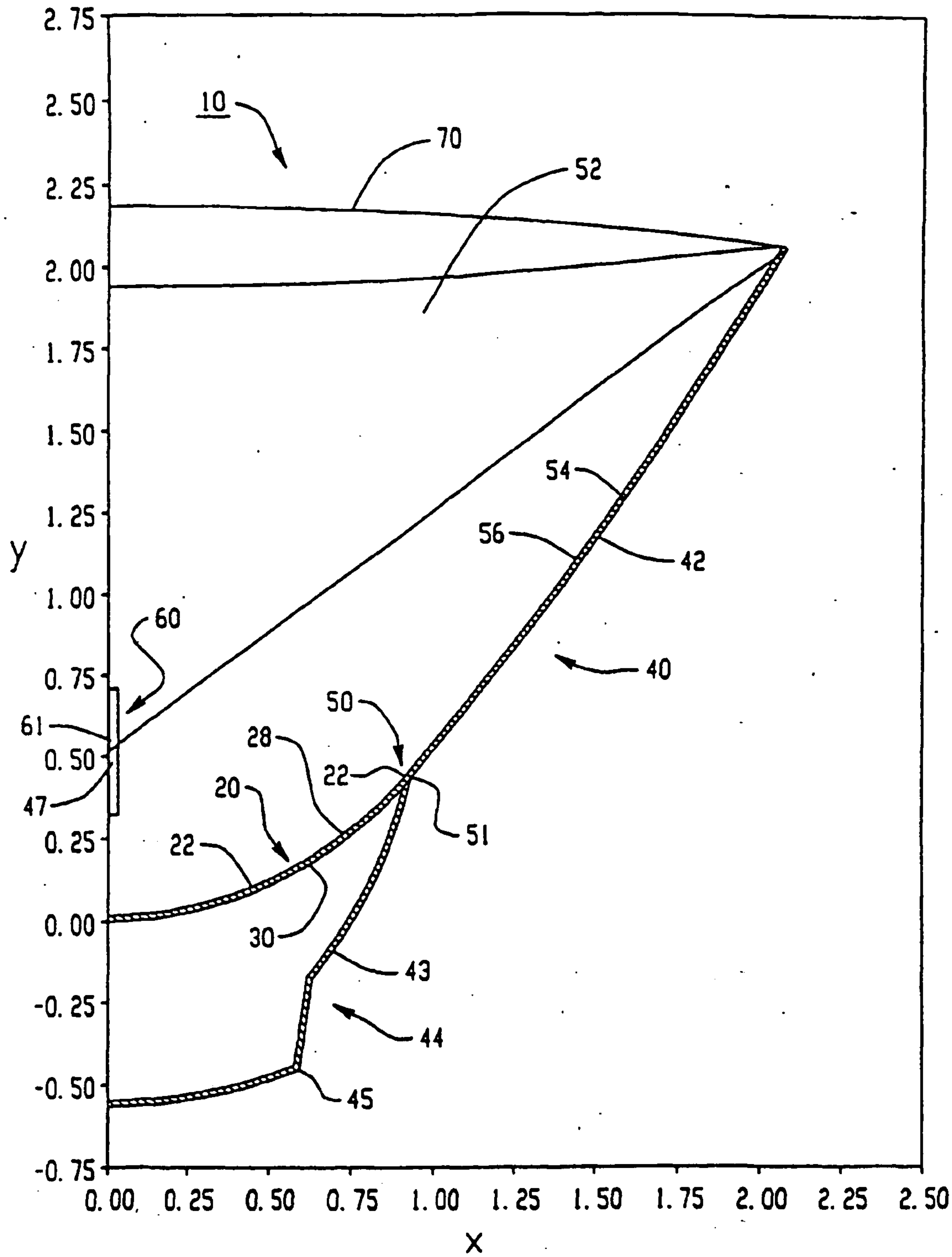
Fig. 1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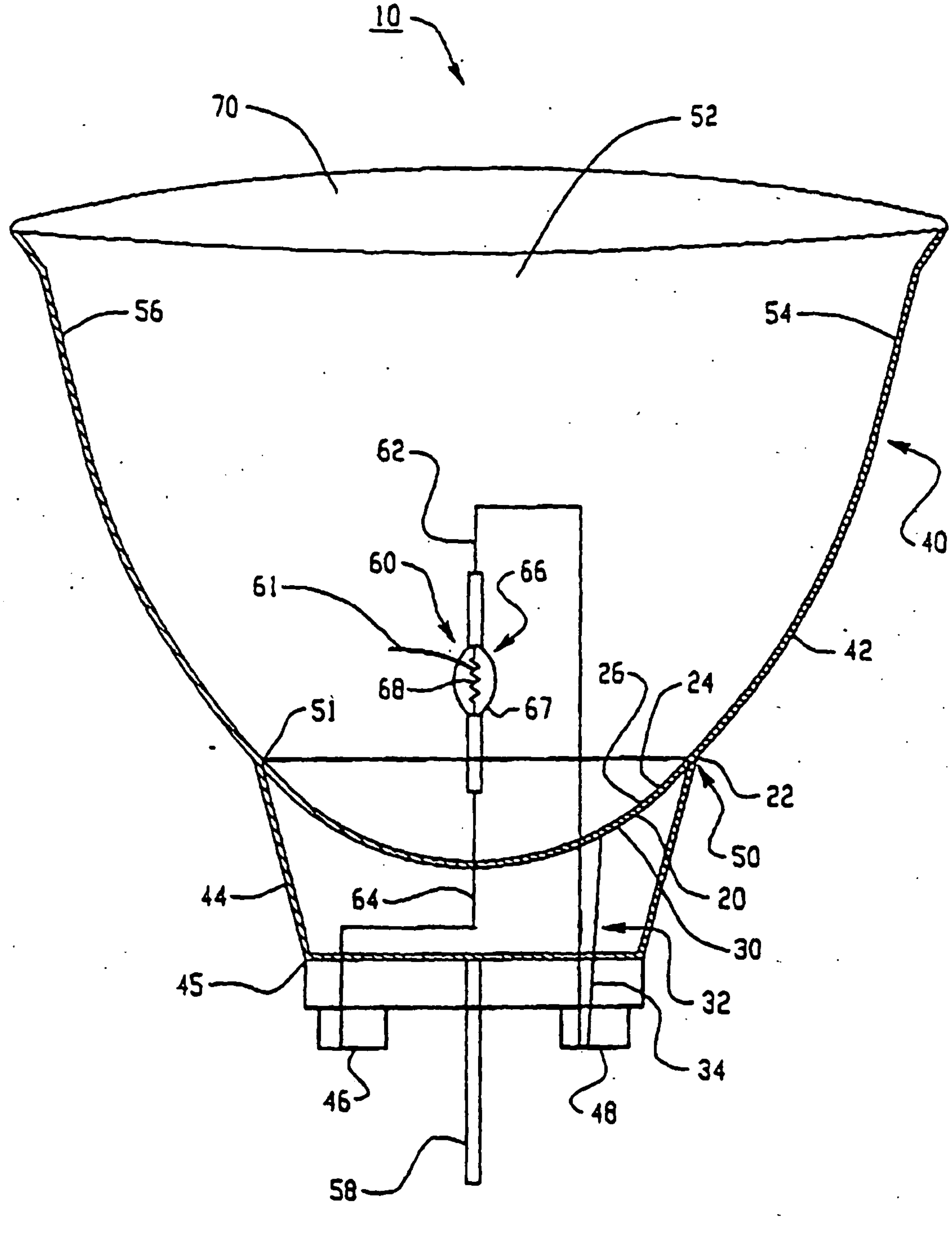
1. 50
1. 25
1. 00
0. 75
0. 50
0. 25
0. 00
-0. 25
-0. 50
-0. 75
y
0. 00
0. 25
0. 50
0. 75
1. 00
1. 25
1. 50
1. 75
2. 00
2. 25
2. 50
x
10
70
52
54
56
42
60
40
61
47
50
28
22
20
51
22
30
43
44
45

Fig. 2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48
58

Fig. 3

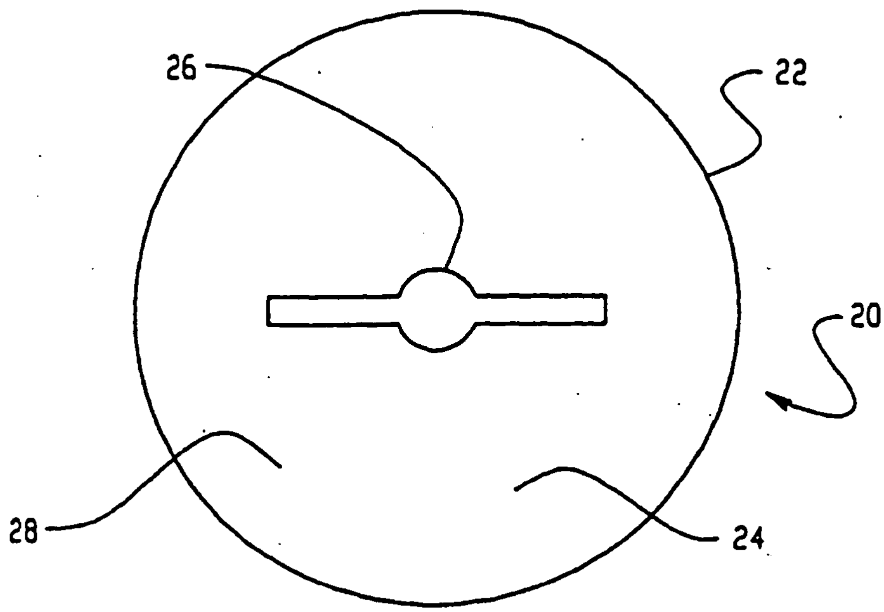

Fig. 4

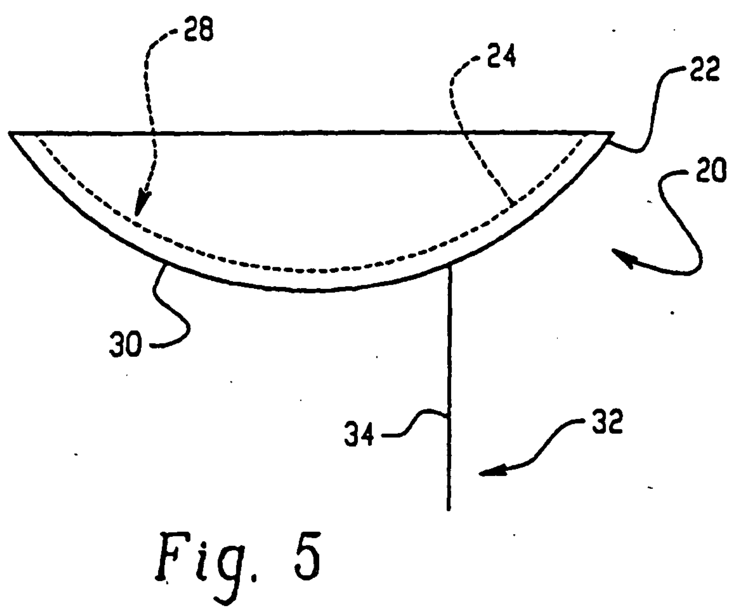

Fig. 5